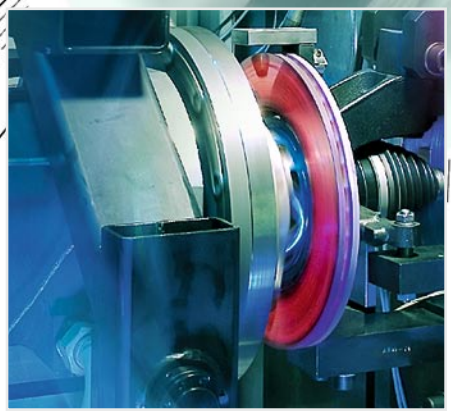
Test Rigs for Car Wheel Bearings with an XC 600 Head End Controller



FAG Kugelfischer develops, manufactures and sells rolling bearings all over the world for the automotive industry. A PC-based controller is used for simulating different driving tracks. Several XC100 and XC200 compact PLCs are networked via CANopen to a Moeller high-performance XC600 head end controller in order to simulate the high dynamic forces or movements in the test rigs.

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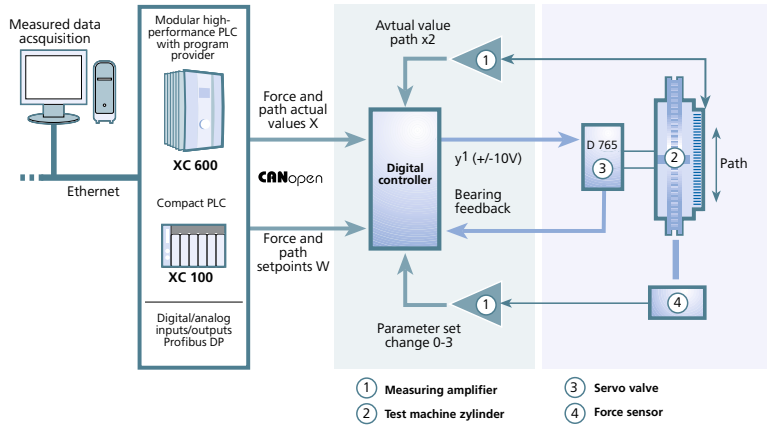
THE COMPANY

FAG Kugelfischer AG, with over 100 years of company tradition, is a world leader in the production of precision rolling bearings for the automotive, machine building and aerospace industries. The company achieved a turnover of 2.2 billion euros in 2003 and has 17,600 employees worldwide in 27 locations, including nearly 5,000 at the company headquarters in Schweinfurt. Since January 1 2002 FAG Kugelfischer AG has belonged to the Schaeffler Group based in Herzogenaurach.

High Dynamic Two Axis Hydraulic Controller



FAG Kugelfischer AG is a development partner for the automotive industry with operations worldwide. One important product line involves the development and production of wheel bearings for cars and utility vehicles. FAG continuously carries out testing and simulations in order to ensure their high quality standard. Testing covers a wide range of different areas, and so FAG not only tests lifespan but also the reaction of the wheel bearings to different forces. The forces applied at the test rig are a very accurate simulation of the collective load, enabling for example the simulation of forces and movements produced on the motor racing tracks at Hockenheim and Nürburg. This requires the simulation of the smallest ground undulations and steering movements on the test rig. For this FAG requires a high-performance PLC with a large data memory and fast analog inputs and outputs in the periphery.

FAG Kugelfischer have for a long time also used Moeller products to meet continuously growing requirements. As previously mentioned, the new test rig uses an XC600 as the head end controller. The XC600 PLC in PC104+ format with integrated OPC, web server and Ethernet on board provides the connection to the control system supplied by Hesotech. The control system is used to control and monitor the entire test rig. The XC600 receives the data packets via FTP for the different drive tracks which the PLC as the program provider has to simulate. The data packets of approx. 20 MB contain for example measured values that were recorded on an actual drive on the Hockenheim ring. The large data volume has to be processed by the PLC within a cycle time of 1 ms. CoDeSys was required for the IEC61131-3 programming language. These requirements are why FAG chooses the Moeller XC600 as the standard head end controller for demanding test rigs.

Different ambient temperatures can also be simulated on the test rig. The PID split range controllers for heating or cooling, and the pulse width modulation function blocks from the Moeller Closed-Loop Control Toolbox are also used. Temperature regulation is processed as a "slow task" of the XC600, without affecting the performance of the "fast task" for outputting the recorded force and position data. The CAN bus passes on the force and position data to a remote Moeller XC200 compact PLC, where the high dynamic force or position (optional) control is carried out within a PLC cycle time of one millisecond. The conversion times for recording actual values and outputting manipulated variables are less than a millisecond.

Several XC100 and XC200 compact PLCs are networked via CANopen on the XC600 head end PLC in order to simulate the high dynamic forces or paths. The CANopen network furthermore includes six Moog controllers that are also programmed with CoDeSys like all Moeller XC PLCs. This enables the entire test rig to be programmed with one software. The flexible Moeller XSoft programming environment is IEC61131-3 compliant, works with the CoDeSys runtime system and supports programming, configuration, test and commissioning and visualization.

Moeller software libraries are the central programming tools for all Moeller PLCs. The tried and tested, branch-specific function blocks simplify programming, whilst comprehensive function block libraries for closed-loop and motion control can be integrated into the CoDeSys programming environment with the library management functions.

Several XI/OC analog combination modules are connected to the remote XC100 and XC200 PLCs. The modules are designed to convert the analog signals at high speed so that the signals are available for the CPU in less than one millisecond. This is an indispensable requirement for the realistic open and closed-loop control of high dynamic forces or movements. Communication via CANopen to the master PLC which specifies the setpoints as the program provider does not result in any performance loss. The overall solution results in an extremely fast and dynamic closed-loop and open-loop control of the test rig.

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CONCLUSION

Reinhold Korn, head of system engineering for testing at FAG, said the following about the project: "The PC-based XC600 PLC and the remote XC PLCs enable optimum simulation of measured values recorded on actual test tracks. A key advantage of this system is that we can realistically test the quality and load bearing capacity of the different rolling bearings on the test rig in Schweinfurt. This saves time and money without any loss in quality".

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